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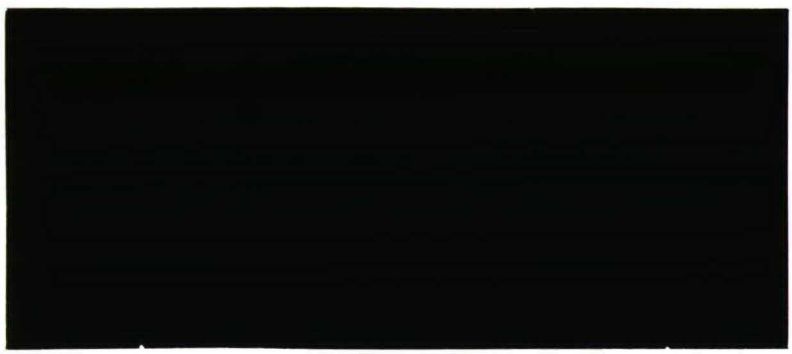

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Pragmatics of Postdeterminers, Non-restrictive Modifications and Wh-phrases.

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ABSTRACT

Postdeterminers and non-restrictive modifications do not contribute to the semantic content, but convey information about the speaker's underlying beliefs. They contribute to the determination and maintenance of the non-linguistic context of dialogue. As these beliefs derive from the linguistic surface structure, grammar formalisms must provide a way to generate appropriate representations, to be used by a dialogue manager for maintaining a user-model and a consistent model of common knowledge. The technical details of this approach are described within the frame-work of Discontinuous Phrase Structure Grammar (DPSG). Within this approach, *reactions* to wh-questions with conflicting underlying beliefs are explained and formulated in terms of *indirect interpretations of these beliefs.*

1 Introduction

In this paper I explore the idea of generating presuppositions on the basis of a phrase structure analysis of sentences. The first to introduce this technique were Karttunen and Peters (1979), who showed that non-truthfunctional aspects of meaning could be described within PTQ (Montague 1974) in a recursive way. They focussed on conventional implicatures as opposed to presuppositions and conversational implicatures (Grice 1975). Recently, this recursive technique has also been applied to the generation of complex discourse referents (Dols 1989a). These pragmatic extensions to syntactic-semantic grammar formalisms are much needed if we expect a dialogue system to play an intelligent part in natural language dialogues (Dols 1990).

Some non-truthfunctional aspects of meaning are conventionally linked to certain words or phrases, which is why these aspects are called *conventional implicatures.* This conventional aspect implies

that these implicatures can *not* be canceled by contextual information. Karttunen and Peters' first example is *Even Bill likes Mary*: what is expressed by *even* plays no role in determining the truthfunctional meaning of the sentence.

In the following sections, I will give a formal recursive treatment of non-truthfunctional aspects of postdeterminers, non-restrictive modifications and wh-phrases.
I will show in detail how the corresponding implicatures are generated in an augmented phrase-structure grammar with a built-in framework for dealing with discontinuities (DPSG, Bunt et al. 1987). Second, I will show that (not only the wh-determiner but also) its underlying presupposition has wide scope with respect to the related verbal constituent. The possible answers to wh-questions with *failing* presupposition are explained in terms of this wide-scope analysis. Using a simple inference rule the answers can be shown to derive from the representation of the *presupposition* rather than that of the semantic content.

2 Preliminary details of the grammar formalism

The grammar rules used in this paper consist of a syntactic, semantic and presupposition part. The rules are identified using numbers together with required relevant feature values. I use primes to indicate the semantic parts and + for presupposition parts. There is, of course, also a part containing conditions on feature-value pairs, their distribution over the constituents, and feature-value assignments. However, this part will be left out to make the grammar rules more readable.
I will first give straight-forward grammar rules for singular definite descriptions. They exemplify the use of the presupposition part and show typical details of the representation language that need to be explained. Note, how the semantics of the constituents contributes

to the *denotation conditions* in the presupposition part of a rule, but *never* the other way around: meaning-aspects introduced by the presupposition-bearing components are never incorporated into the semantic rules. This ensures that the semantic content is independent of the presuppositional content.

(rule 1)

(1) NPCENTRE → NP
(1' singular) λ P: P(NPCENTRE')
(1^+ singular) COUNT(NPCENTRE$^+$) == ONE

An NPCENTRE is defined by the following rule, where CENTRALDET is a lexical item from the group of articles, possessives, wh-determiners and demonstratives, and NOM denotes a (complex) nominal:

(rule 2)

(2) CENTRALDET + NOM → NPCENTRE
(2' singular) !(NOM', λ X: CENTRALDET'(X))
(2^+ singular) SELECT(NOM', λ X: CENTRALDET'(X))

Following Bunt (1985), CENTRALDETs have only one semantic representation in the lexicon, a polymorphic characteristic function CR, which refers to *the context of an utterance*, and defines the set of contextually relevant entities. The exclamation mark represents *a typed bounded uniqueness operator*. For example, using rule (1) and (2), the semantics of the NP *that man* is represented as λ P: P(!(MAN, λ X: CR(X))). Its corresponding combined existence and uniqueness presuppositions according to (1^+) and (2^+) is represented as COUNT(SELECT(MAN, λ X: CR(X))) == ONE. A rule applying the NP to a verbal constituent (represented as a predicate) yielding a sentence is trivial. For more details, in particular the bounded uniqueness operator, see Dols (1989b).

3 Postdeterminers

The function of a postdeterminer like 'three' in *The three boys sing* is to express a presupposition about the plural head noun 'boys'. The speaker believes that the set of boys, the *source*, consists of three elements. This presupposition can be represented and generated as follows. A postdeterminer POSTDET (rule 3) and a nominal constitute a POSTNOM (rule 4), which together with a central determiner forms a NPCENTRE (rule 5). This NPCENTRE is lifted to a full-fledged NP by a plural variant of rule 1 (not listed), which takes over the presupposition of the NPCENTRE.

(rule 3)

(3 plural) NUMBER → POSTDET
(3' plural) postdeterminers don't contribute to the semantic content
(3^+ plural) λ X: λ P: COUNT(SELECT(X, λ x: P(x))) == NUMBER'

(rule 4)

(4 plural) POSTDET + NOM → POSTNOM
(4' plural) NOM'
(4^+ plural) POSTDET^+(NOM')

The presupposition part of the NPCENTRE in rule (5 plural) consists of an application of the *presupposition part* of the postnom to the *semantic part* of the central determiner.

(rule 5)

(5 plural) CENTRALDET + POSTNOM → NPCENTRE
(5' plural) SELECT(POSTNOM', λ x: CENTRALDET'(x))
(5^+ plural) POSTNOM^+(CENTRALDET')

The final result of applying rule (3), (4^+) and (5^+) to *The three*

boys represnts after λ-conversion the presupposition that there are exactly three contextually relevant boys: COUNT(SELECT(BOYS, λ X: CR(X))) == THREE

4 Non-restrictive modifiers

In this section I am concerned with non-restrictive modification of plural head nouns. A modifier following a deictic central determiner never restricts the source: it is a non-restrictive modifier. For example, in *These defect planes are being tested* the source is completely determined by 'these planes'. The semantic representation of plural descriptions is complicated due to various ways a predicate may be applied to the source. For example, in *These boys sing* the boys may sing individually or collectively. The formalism used here to represent aspects of distribution has been adapted from Bunt (1985) and explained in detail in Dols (1989b); For now I will confine myself to the following.

The various ways are represented by a distribution function δ, which is applied to the source and the predicate. Thus, δ(BOYS, SING) denotes the set of boys and possibly groupings of boys, that sing: the *involvement*. When referring to the boys that are involved in singing, the *sets* of boys should not be counted as being involved. For this reason, a special union operator $\cup^*$ is introduced, flattening (Sterling and Shapiro 1986) the involvement until the elements from the source are encountered.

Central modification may be composed of a number of adjacent modifications, as in *These old ugly worthless hulks are being sold*, or *These painted heavy boats are for sale*. The *accumulated conventional implicature* of this last sentence is:

$\forall$(SELECT(BOATS, CR), λ X: (X $\in \cup^*$(δ(SELECT(BOATS, CR), λ X: PAINTED(X))) $\wedge$ X $\in \cup^*$(δ(SELECT(BOATS, CR), λ X: HEAVY(X)))))

It expresses that all elements of the source are involved in the painting *and* all are involved in being heavy. Each modification has its own

distribution, and denotes the set (of groupings) of elements of the relevant boats satisfying the modification. This forms a sharp contrast to the semantic content, which is simply paraphrased as *These boats are for sale*, represented as
$\forall$(SELECT(BOATS, CR), λ X: FOR-SAIL(X))
The following rules combine in a recursive way the presupposition part of a (complex) CENTRALMOD with that of a nominal constituent. The rule for the nominal constituent (rule 7) contains in its presupposition part the abstract implicature used to start up the recursion. To start with, a CENTRALMOD is constructed from an adjective represented as a predicate:

(rule 6)

(6) ADJ $\rightarrow$ CENTRALMOD
(6') non-restrictive modifiers don't add to the semantic content
(6^+) λ X: δ(X, λ x: ADJ'(x))

Rule (7) takes over the semantic part of its noun constituent, introducing the starter implicature, mentioned above.

(rule 7)

(7) NOUN $\rightarrow$ NOM
(7') NOUN'
(7^+) λ P: λ x: TRUE

Rule (8) combines a CENTRALMOD with a NOM, forming in its presupposition part an *accumulated implicature abstraction*; the accumulation derives from recursively applying (8) and (6), where the previous result of (8^+) is substituted for NOM^+ in the next application of (8^+).

(rule 8)

(8) CENTRALMOD + NOM $\rightarrow$ NOM
(8') NOM'
(8^+) λ P: λ y: ((NOM^+(P))(y) $\wedge$
y $\in$ $\cup^*$(CENTRALMOD^+(SELECT(NOM',P))))

Of each individual y the implicature in rule (8^+) determines whether or not it is involved *in each* of the modifications of the denotation of the noun, restricted by P. Finally, rule (2 plural) below for plural NPCENTREs has a presupposition part expressing the involvement of the source. Together, rule (8^+) and (2^+) represent that the involvement is universal with respect to each of the possible modifications of the source. Their respective distributions are determined in (2^+) by NOM^+, the final accumulated implicature abstraction of the nominal constituent.

(rule 2 continued)

(2' plural) SELECT(NOM', λ X: CENTRALDET'(X))
(2^+ plural) $\forall$(SELECT(NOM', CENTRALDET'), NOM^+(CENTRALDET'))

Finally, we must add the plural variant for rule (1); it takes over the accumulated implicature of the NPCENTRE.

(rule 1 continued)

(rule 1' plural) λ P: $\forall$(NPCENTRE', λ X: X $\in \cup^*(\delta$(NPCENTRE', P)))
(rule 1^+ plural) NPCENTRE^+

Natural language phrases (and sentences, of course) often introduce more than one presupposition. When applying a grammar rule, how do we distinguish between multiple implicatures that may be associated with one and the same constituent? An ad hoc method is to number the presuppositions throughout the grammar rules when designing them.

In general the control mechanism of a dialogue system first evaluates the presuppositions and acts according to the results. This is the way

implied by Strawson (1950), which is accepted by most computational linguists and pragmaticians and which makes a cooperative reaction possible. In the next section I will explain *how* a cooperative reaction can be generated in case of serious implicature disagreement.

5 Presuppositions and dialogue control acts

Wh-determiners have wide scope with respect to the related verbal constituent. This is also true of their presuppositions. The uniqueness and existential presuppositions have a wide scope. In *The plane is due* the presupposition is that there is a unique *plane* (given the context) which is due. But in *Which plane is due* the presupposition is that there is one *plane which is due* (given the context). This presupposition can be generated in exactly the same way the implicatures treated in the the previous sections are generated.

There are two main views regarding the way how to deal with failing presuppositions of wh-questions (Groenendijk and Stokhof 1984, 31). The semantic point of view results in failing to have an answer. The response would be a mere reply. For example, *Which book did he take* cannot have a (true or false) answer if no book has been taken. The *response* would rather be '**none**'.

According to the pragmatic point of view presuppositions are expectations about the answer. Failure then results in an answer including 'correcting' information. For example, if two books have been taken, the correction plus *answer* would be '**(actually there were two,) these two**'. How are both these reactions to be produced in terms of the representations? Starting from the representation of presuppositions both reactions may be explained as *indirect interpretations* of the presupposition. The semantic content of the wh-question is represented as

!(SELECT(BOOKS, CR), λ X: TAKES(HE, X))

and the presupposition as

COUNT(SELECT(SELECT(BOOKS, CR), λ X: TAKES(HE, X))) == ONE.

We assume a heuristic rule that extracts from the failing presupposition the subexpression SELECT(SELECT(BOOKS, CR), λ X: TAKES(HE, X)).
This expression is considered to be an indirect interpretation of the wh-question that itself had no denotation. Evaluation of this indirect question now provides in the respective cases the empty set or the set of two books, that is, the two values on which the *cooperative reactions* are based. This technique for indirect interpretations has been implemented in the TENDUM dialogue system (Bunt et al. 1984; Bunt 1988, 6.2.2). Thus, the distinction between the notion of an answer as opposed to a reply seems superfluous. Both the reply and the answer are generated from the same presupposition and they both imply the system to expect that the partner *could not correctly ask the question again.* After the reaction, the partner is expected to know that the presupposition is not true and in addition one of the conditions for correctly asking (that is, not having information about the answer) will no longer be satisfied.

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